

**THE WORKER, FIRM, AND REGION NEXUS:
HOW REAL PEOPLE AND REAL WORK SHAPE REGIONAL INNOVATIVE
CAPACITY IN THE KNOWLEDGE-BASED INDUSTRY**

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ABSTRACT

This study proposes to rethink the current framework of the innovative region by placing an emphasis on a much under-studied dimension: the workforce and organizational capacity. In particular, this paper pays attention to commitment-based HR practices as critical factors in shaping organizational competency and innovation. Existing studies on innovation at the regional scale have identified a set of factors external to organizations as the main mechanisms of innovation, including knowledge spillover, local or global collaboration, and proximity to research universities and institutions. However, there is increasing evidence that the exclusive emphasis on external factors of innovation may capture only one side of a continuum in which creativity and innovation are strongly influenced by internal organizational factors – i.e. internal skill pools and workplace culture (Lampel, Lant, and Shamsie, 2000; Collins and Smith, 2006).

I propose a new conceptual framework for the workforce-firm-region nexus and analyze the case of a high technology community in Seoul. Using the new conceptual framework and drawing from both survey data and in-depth interviews, the case study magnifies the relationship between workers and firm performance, as well as the importance of a firm's human resource management practice in reinforcing the reciprocity between workers and a firm. I present that the roles carried out by workers in day-to-day routines are an important source of new ideas and product development. I also show evidence that commitment-based employment practices shape the firm-specific human resource that are critical in creating a distinctive competitive advantage for firms, whose aggregate success ultimately translates to local and regional economic strength.

Finally, I propose to extend the current theoretic framework of innovation studies in the knowledge-based industries into workforce and human resource practice dimensions and explore the directions of local and regional policies that potentially strengthen the worker-employer relationship in a way that increases the employment rate and continued growth of workforce.

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Keywords: labor requirement, organizational practice, innovation, local and regional workforce policies

INTRODUCTION

This study proposes to rethink the current framework of innovative region by placing an emphasis on a much under-studied dimension: the workforce and organizational capacity. In the 1990s, the rise of agglomeration economies with higher rate of innovation in developed countries was followed by the proliferation of scholarly and policy debates on the reasons for agglomeration and whether and how spatial agglomeration is related to innovation. Yet, despite the wealth of the innovative region literature, very little is discussed about the workforce dimension and the corresponding human resource (HR) practices of firms. To a layperson, it seems obvious that knowledge and new ideas are inherently embodied in individuals, and the process of new knowledge creation depends in part on social interactions among people who share similar knowledge. If that is so, the study of innovation should pay attention to a workforce dimension where an individuals' economic actions are typically not exclusively determined by profit-maximizing self-interest but are often done out of social motivations such as loyalty to another person, to an organization, or to bigger ideals and ethically superior goals.

In this light, a firm that can attract individuals who pursue similar goals (for instance, developing certain technologies or new products) and bind them into interactions that allow or stimulate them to create economically viable innovations gains an advantage. Thus, while regional systemic influence and external knowledge are important, a firm's capacity to recognize and utilize the knowledge and innovation created at the shop floor is critical for shaping the organization's distinctive competitive advantage. In much of the innovative region literature of the last few decades, however, non-human factors—spatial proximity and local institutions--have prevailed as the key elements of innovation, and still dominate the discourse.

The limited scope of discussions on workforce in the context of innovation may stem as much from the difficulties of measuring human actions and their direct contributions to innovation as from the inadequacy of the existing conceptual framework. However, given that we can only address the measurement problems after we have some theoretic concept of what we are to measure, this paper starts by exploring the 'conceptual hole' in the literature. I do it by critically reviewing the different bodies of literature related to innovative regions and discussing what is bottlenecking intellectual engagement with the workforce dimension and the employment practices.

A close exploration of the literature reveals that ignorance of the workforce dimension and HR practice might be rooted in the fact that the current literature places too much emphasis on factors external to organizations, such as knowledge spillover, local or global collaboration, and proximity to research universities and institutions, as the main mechanisms of innovation. Presently, however, there is increasing evidence showing that the exclusive emphasis on external factors of innovation may in fact only capture one side of a continuum in which creativity and innovation are strongly influenced by internal organizational factors – i.e. internal skill pools and workplace culture (Lampel, Lant, and Shamsie, 2000; Collins and Smith, 2006).

In order to open up a discourse about workforce and employment practices, this paper presents research conducted on the production organization, workforce requirements and employment practices in small and medium sized firms in the digital content industry in Seoul. The narratives drawn from small and medium size content developers are illuminating. Data from surveys and in-depth interviews on digital content developers in Seoul highlights the key role played by knowledge workers not only in routine tasks of digital content development, but in effectively utilizing external resources, such as partnerships with large corporations, bringing in new projects and obtaining critical market information. More importantly, knowledge workers shape organization specific successful digital content products.

Understanding the role of workforce in the regional economy in the context of an organization is important, because as Scott (2006) pointed out, the mere presence of “creative people” is not enough to sustain and regenerate new knowledge, innovation, and economic growth; the mechanism by which a congregation of creative individuals induces or becomes incorporated in the existing mechanism of local economic growth. This reflects an important reality. Although individuals operating as atomic and autonomous self-organizing entrepreneurs have increased in many industry sectors, individual workers are still part of established production systems and formal organizations (firms) (Jung, 2010).

While popular policy prescriptions have been largely disconnected from local and regional labor market realities, technology firms suffer all of the traditional challenges in local economic development, such as jobs and human resources mismatches, problems of workforce training and retention, and the formal and informal governance of local and regional employment practice.

This paper is composed as follows. The next section critically reviews the literature and is followed by the research on the digital content industry in Seoul, Korea. The data are drawn from

a survey of software firms in Seoul conducted in 2004 and in-depth interview data conducted in 2005. Next, I will discuss the possible theoretic, methodological and policy contributions of the findings of this research as an initial anchor for further discussion on how we can incorporate the workforce dimension into the equation of innovation. I propose a new conceptual framework: workforce-firm-region nexus. This study concludes by proposing a rethinking of the current framework by placing emphasis on a much under-studied dimension: the workforce and a firm's the organizational capacity to recognize shop floor knowledge.

Special attention is given to small and medium size enterprises (SMEs) in this paper. Although a growing number of studies have compiled evidence that small and medium sized firms lead innovation in newly emerging industry sectors, resulting in the U-shaped curve of the rate of innovation in relation to firm size, not many studies have paid attention to the internal capacity of SMEs and how they cultivate organizational competence. Findings concerned with the internal capacities of SMEs will stimulate further research and will fill an important hole in existing knowledge of local and regional development.

Definition of the Digital Content Industry

In this study, I use the term digital content industry to indicate a broader set of related industry subsectors, ranging from enabling software embedded in other sectors such as film, internet digital content, and online education to major content developing activities such as digital publishing, digital animation, video game, online and mobile gaming, and mobile phone application development. With its world-wide standardization and continuous incremental advances in information and communication technology, especially in the telecommunication sector, the digital content industry is one of the world's fastest growing industries. One report shows that its annual growth rate has been 15% for the last several years and predicts that the trend will continue for the next 10 years (KIPA, 2005). The advantage of the electronic form of content is evident: the content creator can diversify its revenue generating model. For instance, a digitized movie can be downloaded and viewed either on an iPhone, iPad, or personal computer. Incremental technological development in the end-user device market (for instance, the introduction of mobile G2, G3, G4, iPad, and iPod) increases the benefits of its “one-source, multi-use” characteristics, and predictions of market growth for the industry show an upward slope. In terms of world market share, North America is the biggest player in digital content,

occupying 40.7% of the market as of 2006. East Asian countries, however, are the regional market with the fastest growth rate, 35.3%.

“INTERPERSONAL” REGIONAL WORLD OF INNOVATION WITH A THIN TRACE OF REAL PEOPLE

There are two parallel approaches explaining the agglomeration of firms: the increasing-returns school holds that agglomeration is a result of individual maximization based on transaction-cost theory, while the complexity school approach is based on non-mainstream assumptions such as imperfect information and competition, multiple pathways of development models, and the important roles played by rules, norms, and conventions. The latter gave a profound theoretic base for regional science and economic geography, which will be the focus of the following review of the literature.

Tacit Dimension of knowledge, High-order Knowledge, and Spatiality of Innovation

In the mid-1980s, Piore and Sabel, modeling from the Third Italy's industry districts, proposed trust and shared culture as important elements for sustained innovative capacity (Piore and Sabel, 1984; Sabel, 1990). In the US context, scholars expanded the discussion to assert that flexible specialization is the outcome of the very strong tendency toward vertical disintegration, with small firms agglomerating to compensate for scarce resources through information exchange and co-projects (Saxenian, 1994). Thus, proximity allows the pooling of technical expertise and skilled labor and socializing the risk of venturing into new industry sectors. These advantages were thought not only to provide stable business environments but also to allow continual innovation (Porter, 1990 add more people in this group). In these studies, proximity among firms was used to measure the effect of geographical clustering; while the pooling effect was measured through R&D expenditures and the number of researchers of firms in the local area.

Another strand argued that the effect of spatial proximity on a firm's capacity goes beyond merely saving transaction costs, sharing informal information, pooling local labor and enhancing local collaboration. They held that there is a socio-spatial logic inherent to knowledge transfer and learning, which they refer to as *untraded interdependencies* (Storper, 1997). The knowledge transmission and learning that precedes innovation is geographically bounded if,

given the often tacit nature of the knowledge responsible for innovation, the knowledge-producing sources must be proximate to enable spillover to occur. In this approach, space is conceptualized as more than a physical space between actors and place to agglomerate. It can, in addition, provide a strong sense of belonging when a set of regionally specific relationships are established between firms, institutions, and people, resulting in the highly developed capacity for cooperation typical of culturally similar people and institutions.

Learning Region, Collective Learning, and Knowledge Transfer

Scholars whose work is based on the concept of knowledge management have argued that the learning capacity of a region determines the ability to continuously innovate and grow, which is reflected in learning economies (Lundvall 1992), learning regions (Asheim, 1997), and regional innovation systems (Cooke and Morgan, 1998). Localization, they argue, matters because spatial proximity facilitates learning, especially by enabling the transfer of tacit knowledge (Lawson and Lorenz, 1999). In these conceptual frameworks, learning capacity and mechanisms are measured by the number of collaborative networks within localities. Capello et al. extended the localized learning concept to localized collective learning (2005). The learning occurs in a collective way among local firms because mobile workers convey new knowledge and technology among local firms. In this framework, localized collective learning was measured by looking at the proportion of newly employed workers from the local labor pool (Capello, 2005).

Global Pipeline, Rivalry, and Breaking-out from lock-in

In reaction to a perceived over-emphasis on strong social ties and homogenous industry as ways of conducting business, another line of research has placed emphasis on the role of diversity, variance, and heterogeneity. Granovetter (1985) and Uzzi and Lancaster (2003) pointed out that over-embeddedness or strong social ties have adverse effects on regional innovation when they result in local lock-in. This perspective argues that firms strategically develop collaborations with long-distance partners in order to break out from the lock-in effect and highlights the importance of paralleling “local buzz” and “global pipelines” (Bathelt, Malmberg, and Maskell, 2004). The antithesis between regional strengths such as homogeneous knowledge

and collaboration and knowledge heterogeneity and rivalry relationships became the central agenda in the regional innovation system literature (Rantisi, 2004; Grabher, 2002).

Combining Internal and External Interactions

A recently developing body of research highlights that both internal and external factors are important for innovation. Unlike Schumpeter who said that an economy is in the air, local or region-specific knowledge does not automatically spread out to individual firms at the same rate or in the same magnitude. Cohen and Levinthal (1990) argue that the individual firm's capacity to recognize, assimilate, interpret and exploit the local or regional knowledge is an important precondition. Prior knowledge related to the knowledge being absorbed is critical to any such effort. Thus R&D activity is a critical determinant of a firm's absorptive capacity as R&D activities can help firms to establish the knowledge needed to adapt ideas from outside. Adopting this thought, some economic geographers have made an effort to link the absorptive capacity (again by using R&D) and external factors such as collaboration and interfirm networks. But there is a gap between the reality and this concept. A growing number of studies have compiled evidence that small and medium sized firms lead innovation in newly emerging industry sectors, resulting in a U-shaped curve of the rate of innovation in relation to firm size. If the rate of innovation were mainly determined by the R&D investment rate, then the curve of the rate of innovation in relation to firm size should be a simple upward slope. This suggests that there is another important dimension unexplained yet.

Creative Industries and Creative Cities

The creative class-based conceptual framework is more focused on the role of creative workers in the process of innovation. However, the account is still limited in that scholars confine creative capacity to the individual and do not pay much mind to the role of organization. Earlier research on organizational practices in creative industries emphasized project-based work organization and the linkage between individuals and organizations as a distinctive characteristic of creative work (Pratt, 2000; Christopherson, 2002). Under the network-based economic structure, the self-organizing project-based group is viewed as best suited to organizing mobile workers to respond to short product cycles and fast changing technology. In evolving and self-

coordinating projects, neither the division of labor between team members nor the coordination of team activities follows traditional management principles (Heydebrand and Miron, 2002).

In this perspective, talented, self-expressive, and bohemian creative individuals are the key element of creative work. Working as ‘free agents’ in order to enjoy ‘creative freedom’, these individuals display a self-organizing and entrepreneurial attitude: they typically work as independent contractors (freelance) or part time in a temporary project setting and collaborate in multiple projects simultaneously (Stolarick and Florida, 2006). This intrinsic mobility of creative people is arguably a central precondition for innovation as well as the diffusion of innovative know-how (Heydebrand and Miron, 2002; Florida and Stolarick, 2006) because creative capacity is embodied in individuals and interactions between individuals with high human capital facilitates spillover and the growth of knowledge (Lucas, 1988).

What Causes the Holes in the Literature?: Critical Discussions

While various accounts have been developed to identify the important elements and mechanisms for a regional capacity to innovate, it seems that these studies implicitly agree upon a few core assumptions. First it seems that the current discourse is conceptually arrested by the post-Fordist production systems and production organization model. With the rise of information and communication technologies, the dismantling of Fordist mass production systems which was followed by the slimming down process of large corporation gave a sudden rise to SMEs (Harrison, 1997). In early 1990s, many commentators controversially claimed that SMEs are the leaders of technology innovation and job creation. While there is a ring of truth to the assertion that lean and agile small firms can quickly respond to changes in technology, market, and consumer environments, they cannot operate as self-sufficient agents. In particular, SMEs lack the internal knowledge pool that large corporations used to enjoy. In a constantly changing technology and market environment, neither firms nor the public sector are the source of all wisdom (Gertler and Wolfe, 2002). A solution was soon found in socializing the risk and pooling resources through interfirm networks.

In this framework, thus, critical knowledge exists outside of firms, specifically in the interactions and knowledge flows between economic entities, such as firms (customers, suppliers, and competitors), research organizations (universities, other public and private research institutions), and public agencies (technology transfer centers, development agencies).

In this framework, learning and interactions are now widely accepted as central elements in the process of technological innovation.

As Gertler and Wolfe (2002) suggest, the important learning activity is the higher order, learning-by-learning, ‘where the (institutional) self-monitoring of the learning process itself becomes an integral feature of the institutional structure.’ In this post-Fordist small firm-centric and network-based new economy model, the critical knowledge and learning process was separated from day-to-day labor activities (learning-by-doing), and attention to the immediate and direct relationship between worker skills, shop-floor innovation and the firm’s performance (both productivity and innovation) withered away. Instead, attention was given to management techniques that allow a free-flowing integrative atmosphere at the level of top and middle knowledge workers and managers (Kanter, 1985). The degrading of the contribution of day-to-day work also resulted in a separation between R&D efforts and production lines that created larger lag-time between technological innovation and production (Flodia and Kenney, 1990).

Second, it seems that together with the “interness” and “flowness” of knowledge, the *spatial proximity* trap over-shadowed the important role of the workforce in knowledge absorption, transition, combination, synthesis and new knowledge creation. In the innovative region literature, the important processes and mechanisms of knowledge transfer are translated into spatial terms: proximity became an important input (social labor division) of production processes (Storper, 1997) that allows firms new opportunities to explore possibilities. The importance of the spatial dimension stem from the critical role of the tacit-dimension of knowledge as a precursor of innovation. Here, the accent was placed on how tacit knowledge *flows between* agents and economic entities, not how such tacit knowledge becomes substantive and codified through interactions with one’s physical and social environment and through the group work environment.

Therefore, in many studies, spatial proximity was operationalized as synonymous with social interactions; and the distance between economic and institutional entities with high knowledge resources was used as an important independent variables of innovation. Recent scholarly discussions brought a more nuanced approach to the “proximity” by teasing out different types of proximity such as cognitive, institutional, organizational, social, and geographical (Boschma, 2005). However, the abstract term ‘proximity’ still does not take us far enough to provide an understanding of the flesh and bones of new knowledge creation.

Third, in operationalizing the concept of knowledge transfer, workers are depicted as the means of conveyance of important knowledge. While there is a ring of truth to this, the model needs a more nuanced approach. In particular, it is important to know in which context a lean production organization, external factors, and a mobile worker-based system can generate positive effects and when it does not.¹ The systemic approach to explaining knowledge diffusion through social networks has definite advantages when the technology is either standardized or simple and firms work in the similar industry sectors. Thus, after the post-war perfect employment regime, the organizational practice of hiring mobile workers as a way to learn from other organizations was popularly adopted by Silicon Valley start ups in 1950s-1960s (Lazonick, 2009).

While this model persisted, especially in the U.S., and the ability of high technology workers to move around, change jobs, and form new businesses has typically has been hailed as the great strength, a growing number of counter arguments have recently called into question the efficacy of the system of unfettered entrepreneurship and labor mobility. They suggest that high levels of turnover disrupts the continuity of high-technology development. Most significantly, hypermobility has made it increasingly difficult for established companies to internalize cycles of innovations (Florida and Kenney, 1990). Consequently, a growing number of studies have documented the actual contribution of mobile workers (high voluntary turnover) to innovation and the evidentiary data shows how different reality is from the accepted wisdom that neither flexible work organizations nor contingent workforce practices are associated with innovation (Dess and Shaw, 1990).

Some studies show us that these labor relations and a firm's employment relations are not simply a matter of an individual firm's decision, but are an important issue for regional corporate governance and the business culture. Vang and Asheim's study is illuminating (2006). They highlighted the case of Bangalore, where workers were highly educated but the absorptive capacity in firms was initially low due to firm strategies centered on 'Body Shopping' (Parthasarathy, 2004). This strategy neither provided much knowledge transfer and interactive

1. There are two types of mobile workforce: the voluntary turnover of high technology intellectual workers and the involuntary layoff of high-technology manual laborers. These two types of mobile workers are the twin offspring of short-term, exploitation-based business models, and the later case is a significant issue in growing income inequality in high-tech industry sector. The different social and economic impacts of "mobility" on lower-end workers requires a conceptual approach highlighting the equity of growth, and that discussion is entitled to indepth and separate research. Therefore, I will limit my engagement with this topic to the controversies concerning the role of voluntary mobile workers in contributing to innovation.

learning, nor did it enhance the local firm's absorptive capacity since the engineers involved in body shopping left whenever another more attractive offer came by. This story tells us that knowledge capacity or regional absorptive capacity alone is not the entire story. It matters how human capital is organized so that individually embodied knowledge and capacity can be transferred to the broader organization, and positive change in that capacity depends on a consensus on ways in which firms operate.

Workforce-Firm-Region Nexus

In this sense, Porter and Saxenian's work is illuminating. Michael Porter, in his book 'Competitive Advantage of Nation' (1990), emphasizes the importance of both exploiting external factors and investing in internal capacity. He argues that firms must invest directly in internal factors through their own training, research, and infrastructure building because, these efforts will lead to the most specialized, and often most important, factors. He also points out that if firms hesitate to make such investments because trained employees leave and technology is copied, they will not be able to remain competitive. Saxenian has shown that equally competitive regions' successes, Silicon Valley and Boston's Route 128, were distinguished by different organizational managerial approaches and regional cultures (1994).

Building on this, I propose a new conceptual approach to reflect the multi-layered relational aspects between workers-firms-region: the worker-firm-region nexus (see Figure 1 in page 13). Indeed knowledge and new ideas are inherently embodied in individuals; thus the labor dimension is important. However, innovation is not the isolated work of genius. In particular, newly emerging industry sectors require the combination of previously unconnected ideas and disciplines, which means that innovation requires heuristic processes to exchange, combine, and synthesize existing knowledge and create new knowledge. In other words, individuals are nested within a firm, which is again nested within a regional and national context. In this social construction view of knowledge, it is the firm that has the advantages and resources needed to attract individuals who pursue similar goals (for instance, developing a certain technology or new product) and 'bind them into interactions that allow or stimulate them to create economically viable innovations.' (Storper, 1997: 57).

In doing so, I borrowed the resource-based view (RBV) of the firm in order to frame my analytic strategies. RBV defines a firm as a bundle of resources – i.e., physical, human capital, and the basis for a competitive advantage of a firm lies primarily in the application of the bundle

of valuable resources at the firm's disposal (Wernerfelt, 1984, p172; Rumelt, 1984, p557-558). When these valuable and rare resources are inimitable and substitutable without great effort, they can sustain a firm's competitive advantage. In explaining the worker-firm, the commitment-based HR literature is illuminating. This view argues that by empowering workers through compensation and incentive policies, firms can increase employees' attachment to the firm and desire to act on behalf of the organization and help employees to develop the kind of firm-specific human capital—knowledge of a firm's products, customers, and work processes--that enables them to engage in day-to-day practice with higher acknowledgement of their work (Batt, 2002).

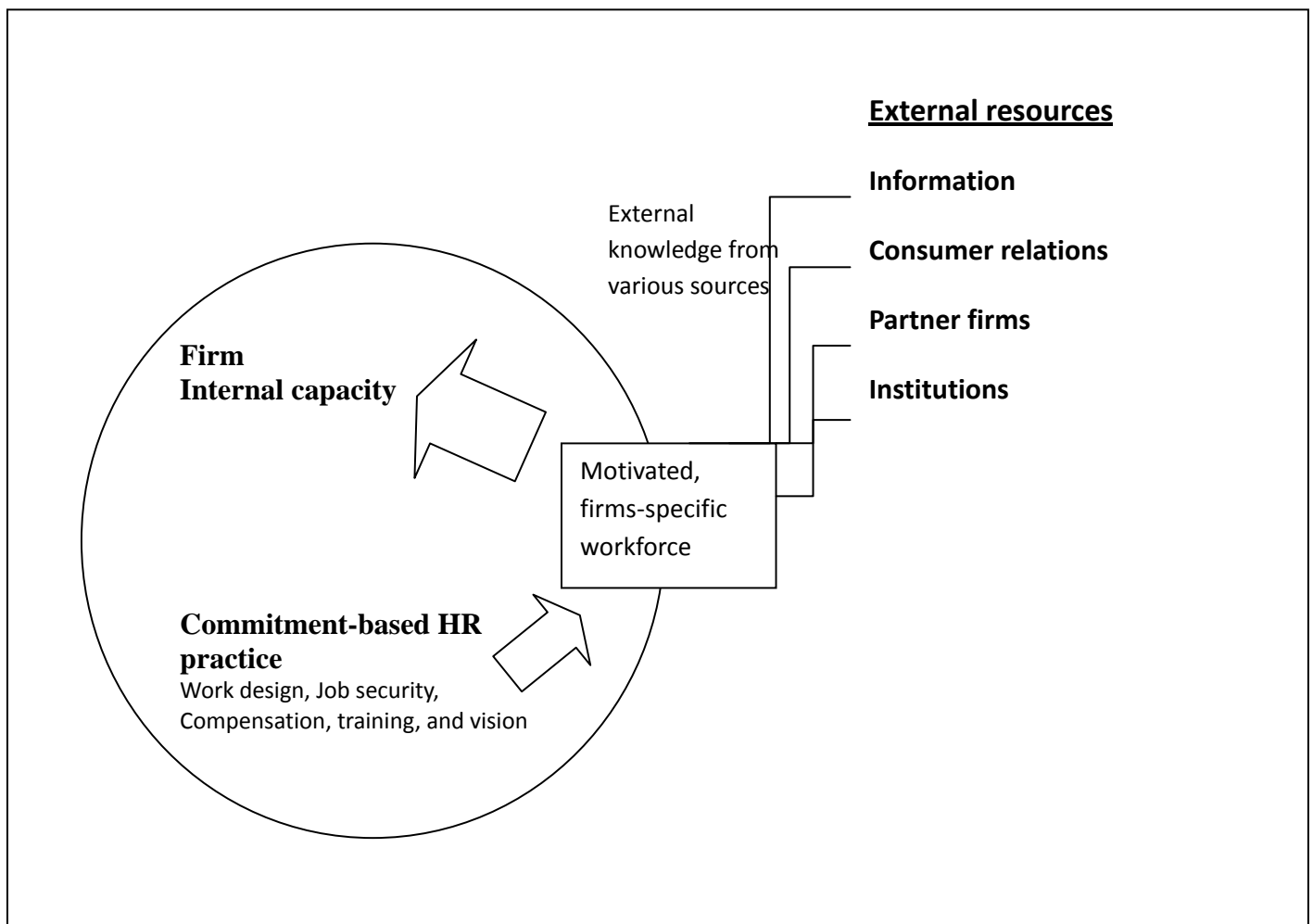


Figure 1. Conceptual diagram of worker-firm-region nexus illustrating how motivated and firm-specific workforce mediates the external sources to a firm's internal capacity (created by the author)

Having these thought in mind, in the next section, I will present research on the role of workers and firms' employment practice in the digital content industry in Seoul, Korea, and show how managers recognize the relationship between workers' contributions and firm performance.

ORGANIZING WORKFORCE, CREATIVITY, AND INNOVATION

Data and Methodologies

Seoul is the hotspot of digital content creation in the East Asia DC market (MIC, 2006). The DC industry started growing rapidly in late 1990s in South Korea and became a leading expert-based industry sector in early 2000 (Jeong, 2004). Seoul's influence has been gradually expanding to the world market via the introduction of new revenue making models (Jeong, 2004). Seoul hosts big players in the digital content industry, including mobile phone manufacturers, telecommunication service carriers, internet portal companies, broadcast corporations, and foreign transnational ICT corporations. Despite varying degrees of urban amenity across the city, ICT infrastructure is evenly distributed, and Seoul has multiple digital content industry agglomerations. The growth of DC industry in Seoul is undergirded by the state of art ICT infrastructure and rapidly expanding digital content market led by telecommunication and Internet-related businesses.

While these conditions generate high level of the DC industrial growth momentum they also have draw backs. Being located near large corporations, SMEs are exposed to possible skilled labor poaching. Constantly changing consumers' taste is also a great challenge for SMEs since the formula of successful digital content and even the business model that work today might become useless in the near future. Therefore, SMEs are under constant pressure to develop new content and business practices. The low entrance barrier allows many start ups to enter the market which also heightens the competition. Concurrent conditions, such as rapid technological development and fluctuating consumer tastes, the rise of new business models in combination with technological ogress, and new forms of communication and transactions, have all contributed to turbulent knowledge environment. Thus, this paper focuses on whether and how human resource management practices have affected SMEs in the DC industry.

The case is constructed based on data collected from KIPA survey data and in-depth interview data with the digital content developers in Seoul. The survey data are used in analyzing the general characteristics of firms, while the in-depth interview data provide a deeper contextual understanding of the causal and mechanisms underneath that pattern. The in-depth interviews with firms in Seoul were conducted from February 2005 to July 2005 and in January 2006. My semi-structured interviews were with CEOs, the heads of HR management departments, or HR employees. Most of the companies involved were content creators. I also conducted interviews at other significant firms in each industry; suppliers and business service providers, project team leaders of venture company associations, national/ local governments, and academic governmental institutions.

Bosch et al. (2005) suggest whether the knowledge environment is stable or turbulent determines which of the two modes of adaptation and learning suggested by March (1991), exploitation and exploration: in a stable knowledge environment, firms focus on the exploitation of currently existing knowledge. On the other hand, in a turbulent knowledge environment, such as an emerging industrial complex, firms are likely to dedicate their efforts to exploration of new knowledge, which is more closely related to a tacit knowledge dimension. Based on this theory, one can hypothesize that DC firms in Seoul will rely on more on exploration of new knowledge, firm-specific human capital and ways to build distinctive competitive advantage by utilizing both external and internal resources.

Characteristics of the Sample

Digital content creators are small in terms of staff, with an average of 10.05 workers per firm and a range of from 1 to 123. They are also young, with a mean firm age of 5.74 years, of which about 70% are less than six years old and 90% under ten. Unlike the stereotype that the creative sectors are largely organized around mobile workers and temporary project teams, digital content creators in Seoul show high investment in internal labor pools and in-house production systems. Despite their small size and short existence, these firms show high self-reliability and on average, reinvest 30% of net profits into research and development. Both survey data analysis and in-depth interviews showed that, in most cases, firms utilize internal resources to develop new technology (69.04%). When seeking new information, firms rely primarily on the internet (58.82%) and newspapers and magazines (8.04%) rather than face-to-

face interactions (34.12%) including informal social networks, exhibitions and seminars. These distinctive attributes of content creators in Seoul have important implications for social organization among SMEs. The proportion of companies started as independent enterprises (not spin-offs) is 83.9%, far outnumbering spin-offs (11.14%).

1. Deciphering Information from the Turbulent Knowledge Environment

1.1. Tapping into the urban lab: Catching the right signal in the buzz of consumers

The development of new products in the digital content industry begins with collecting user information. Digital content (DC) resides in a turbulent knowledge environment because the industry itself is still relatively new and rapidly diversifying with continuous changes in internet and telecommunication infrastructure and corresponding devices. In this environment, as many scholars argued, it seems that local buzz, business relationships with other firms, and information from intermediary institutions play an important role in socializing the risk. Companies share updated information about the sector through regular CEO breakfast meetings and get support to break into new markets.

Yet, SMEs in Seoul do not appear to be able to access all the information and knowledge critical for their new product development and potential innovation. All players lack sufficient information equally and are faced by the same ‘real’ uncertainty, knowledge transfer and socialization of the risk seem to be limited. There is no rule of thumb or golden formula for success. One interviewee stated: ‘we still attend CEO meetings and attend seminars and conferences, but, in this kind of [limited information] situation you are on your own because no one knows where the market will move to next day. So your hunch is the best bet.’ (from an in-depth interview). In this state of heightened uncertainty and scarce information, the contribution of external knowledge to innovation seems low. Thus digital content developers in Seoul have internalized the production process, as is reflected in the high rate of full time workers.

The ‘hunch’ or ‘a-ha moment’ of new idea development does not occur when sitting deep in an arm-chair. Digital content developers go out in to the world in search of meaningful information. For instance, Company A is a mobile phone solution developer for whom an understanding of user behavior is important to devising new products. Public spaces, such as streets, restaurants, movie theaters, malls, and bars, where their targeted users in late teens and

early 20s usually hang-out function as an urban lab. Content developers go out there and ‘hunt the information’ by observing and researching consumer behavior. Watching what functions consumers use (texting, taking pictures, listening to music, playing with pictures taken and so forth..) and how they use them, helps developers to decide which direction to take among various technological and aesthetical choices. In this way, the free-flowing information in the urban atmosphere is captured, locked and translated into meaningful information. This rich information about consumers leads the way to incremental innovation of product. In this sense, being located at the heart of metropolitan city provides a premium beyond saving in transaction costs and participating in territorialized social networks that justifies the exceptionally higher rent paid in Seoul.

However, one does not automatically grasp consumers’ desire just ‘by being in the buzz.’ An interviewee from company A made a remark that highlights this point:

I think having young workers is definitely helpful in terms of catching up to consumers taste. These young workers share similar culture and mentality with the target consumer group who are teenagers and people in their early twenties. (Interview)

Gathering meaningful information from watching consumers requires a cultural sensitivity and a cognitive map that guides one to figure out the right path in the maze of chaotic information. This understanding is especially critical given that the leading user group in the Korean mobile digital content market is teenagers and adults in their twenties whose taste changes very fast.

1.2. Picking the brains of large corporations

In the digital content industry, large corporations such as Internet portal companies, mobile service providers, and mobile hand-held device manufacturers hold important positions as the Internet and mobile service carrier, publisher of digital content, and the manufacturer of hand-held devices. Large corporations are not in direct competition with content creating SMEs. In that sense, they in complementary and reciprocal relationships. However, large corporation still hold tremendous influence on the business of SMEs because they are the central nodes of information and distribution networks and the major buyers of the digital content products.² For

² For instance, in the US context, ATT is the central node of user information because this company is the provider of mobile service and can collect the user-based data-base.

instance, large corporations' decisions to adopt new technologies and open new services carry disproportionate influence on market diversification, development of new software, and content. Therefore, for small firms in Teheran Valley, market volatility is so high, maintaining partnerships with large firms is vitally important to tap into certainty.

For instance, partnering with mobile service providers stabilizes content product distribution by piggybacking onto powerful brand names in the market, which in turn increases product recognition and helps small firms survive in a highly competitive market. (from an in-depth interview). The relationship also works for the large corporations and helps them maintain their market segments within network service, major operation system development, and manufacturing of devices. The breath, diversity and quality of content supplied by SMEs is key to attracting users.³

Thus, while large and small firms are spatially close, they have important knowledge gaps to navigate if they are to work to mutual advantage. How then does knowledge transfer occur between large and small firms? A CEO level social network is not enough to create the coherence necessary to respond to the pace of technological change and market diversification. Communication has to be between a software programmer at an SME and the person in a partner corporation who knows about the technological changes that will occur (from an in-depth interview). Communication, knowledge exchange and combination occurs among those people who have sufficient specialized knowledge.

An anecdote reveals the tightly interwoven relationship between these big players and SMEs. I revisited Company A about seven months (in January of 2006) after our first face-to-face interview to see whether there had been any changes. Surprisingly, this company underwent an organizational change to adjust to a market environment change. As large corporations started servicing digital content product in full and as the wireless Internet became commercialized, in response to the growing market, there had been a surge of digital content start-up firms. In turn, market competition had become more intense. In response, Company A re-created its organization with specialized squads for each publisher (i.e., SKT, LGT, and KT) and now visits clients three or four times a week. Competition among small firms as content creators means that, after they develop their ideas, they have to "lobby" their clients to get their products selected. According to one interviewee:

3. For instance, Apple's iPhone became successful partly because a wide varieties of applications were first introduced in iPhone which brought the 'first-in-the-market' advantage to iPhone

Under this heightened market uncertainty, information obtained from mobile phone service providers about future market predictions, consumer behavior, or even future projects of major corporations is a valuable resource for small firms seeking to cope with the fast-changing market. The knowledge workers at such firms play both the role of salesmen of the digital content creators' products and that of gatherer of new information from large corporations. They are like missionaries or specially trained action squads at the frontier of new technological development and market diversification.

1.3. Learning from consumers' feedback

In those specialized industry sectors that are born from committed user groups and underground activities, the industry maintains a close relationship with users. Within the digital content industry, knowledge and feedback information from users seems to be more integrated and critical in new product development in the DC industry. In addition, this firm-user group relationship is reciprocal rather than contractual. For instance, a firm cultivates a selective loyal user group and operates them as testers for new program development. The tester groups' input is often critical to completing the new product, because these testers are both keenly aware of trends among users and want the firm to be successful in producing a more user friendly product. This reciprocal relationship is maintained as firms show loyalty to users and place users' satisfaction as the foremost priority.

The connection between loyal users and a firm is usually made by hiring lead users – game maniac becomes a game developer. Therefore the specialists have and maintain a close and loyal relationship with users, and put users' satisfaction at the forefront . Sometimes this connection is a source of tension between project teams and management. While each specialist brings specific knowledge and skills and contributes to the development of new products, they also have their own specialized communities that extend beyond the company.

2. In-house Production System: Melding Different Ideas and Molding New Knowledge

While DC firms make extensive use of technical artifacts, the major processes of digital content production, such as idea development, technological enabling, and the incorporation of

visuals, sounds, and narration, as well as marketing, are all conceived and created through interactive human processes (Augustsson, 2005; Jung 2007a). In the digital content industry, a project team is both the basic organizational unit of product development and the melting pot of different ideas and skills. Each project team consists of workers specialized in various subfields that the whole process requires: Within a project team, the division of labor is determined by task specialization e.g., graphic development, sound and special effects, and technological support. Thus, one project team consisted of workers specialized in various technologies and more diverse sets of cultural content. The process of combining different and specialized knowledge and skills requires a shared code, language, and understanding of the project.

The team meeting is the social arena where new information and new product ideas are poured out, combined, and synthesized and often results in creation of new language to indicate brand new problems or ideas under discussion. The team work is also a critical in linking the new ideas to technology enabling commercialization (See Figure 2). For instance, one team member might come up with a new idea for adapting face-morphing tools for mobile phones, but the development process of such software involves inputs from various specialists and new technological problems emerge and are solved at each step:

These programs also take up a lot of storage and memory space which cannot be done on the individual mobile phone. Instead, the consumer connects to the mobile Internet through their handsets and will use the software that is located in a large capacity server. This means that we also need to invest in server equipment, which in turn requires us to consider the internal rate of return on the initial investment. (Interview)

Thus, the source of creativity as well as efficiency rely on an alchemy among communities of scriptwriters, software programmers, graphic artists, server technicians and even testers. Throughout the entire digital content production process, each specialist brings specific knowledge and skills and contributes to the development of new product, problem solving, but sharing a common language and common references increases their ability to agree on the generic features differentiating a good product from bad one. This common cognitive platform allows them to work collectively as one team.

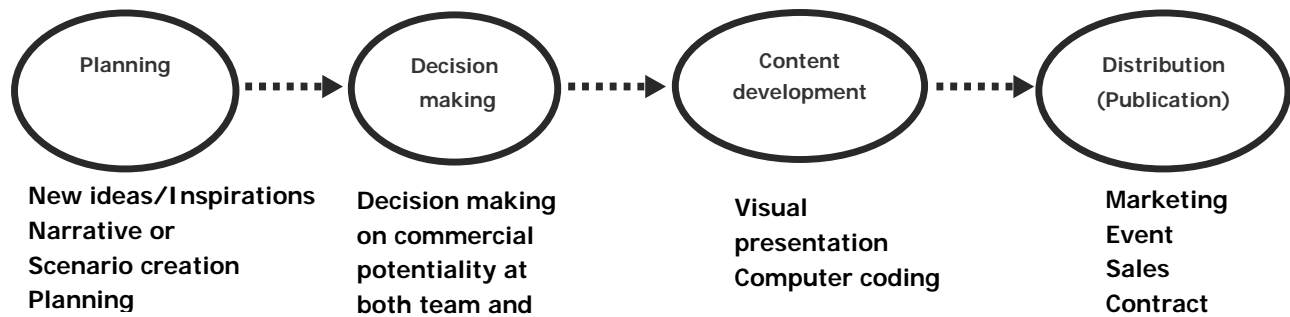


Figure 2. Concept Diagram of Digital Content Production Process (created by the author)

The project leader is often the person who is in charge of new-idea development, communication among the team members, and product development. The team leader is also responsible for communicating with other teams within the firm and with upper level decision makers. Depending on the size of a firm, there can be more than one project being developed simultaneously. To facilitate communication among different project teams, frequent regular meetings are encouraged: for instance team leaders meet every Monday morning as well as holding occasional seminars and conferences whenever needed. And also depending on the capacity and sophistication of the product, such teams have to persist for from several months (mobile phone-based games) to a few years. As the complexity of end user devices (i.e. personal computer, lap top, hand-held devices, and netbook) increases, the size and capacity of digital content also grows, and thus production cost and time period increase too. Knowledge-based workers carry out various tasks from information collection, forming partnerships, idea development and digital content production. Carrying out these tasks require highly specialized skills that are not only formed by school education but also by work experience. For DC firms the real challenge lies in transforming individual and highly fragmented knowledge into a broader organizational shared knowledge. At the same time, breeding firm-specific human resource is crucial because to ‘hunt’ right information and develop ‘hot items’ the workers need clear understandings of the goal of firm, characteristics, strength and weaknesses of the firm’s resources and products, targeted consumer group, and distribution channels. The following narrative reveals several commonly identified firm strategies adopted in order to facilitate knowledge diffusion within the firm.

3. Holding On: Retaining Workers by Investing in Them

3.1. The matrix architecture of knowledge and work design

The human resources challenge for DC firms is to both maintain a highly flexible structure that allows workers to share knowledge both within and outside the team, growing firm specific human capital and retaining those workers long enough to complete complex projects and continue on incremental innovation. The structural solution favored by most firms is matrix organization, which allows both autonomy and control from the top. Retention is dealt with by a variety of practices from higher pay to maintaining an attractive location, and including training and opportunities to do exciting work.

The matrix form of organizational structure is supposedly more facilitative of knowledge sharing and worker participation. At the same time, having semi-autonomous decision making power, a project team is an organization within an organization. Frequent information exchange and meetings among team project leaders are also organizational tool to ensure what is happening within each project team and the individual knowledge will be shared throughout the organization.

The boundaries among project teams are loose so that the mobility of team members is not strictly limited, a structure I term “semi-symbiotic” (see Figure 3). If there is a sudden need for extra labor, the work force within the firm moves around to supply the necessary and short-term labor instead of hiring a short-term temporary workforce. The advantage of improvisation of the existing internal work force is that it reduces the risk of disturbing the existing organizational order and human relationships, which might occur if temporary workers, who often have little sense of the organizational culture, are hired. At the same time, relying on the regular workforce reduces the risk of leaking critical information about new products. This has resulted in strict firm boundaries and competitive relationships among digital content creators. I will discuss this aspect further in the following sections.

Strict firm boundaries

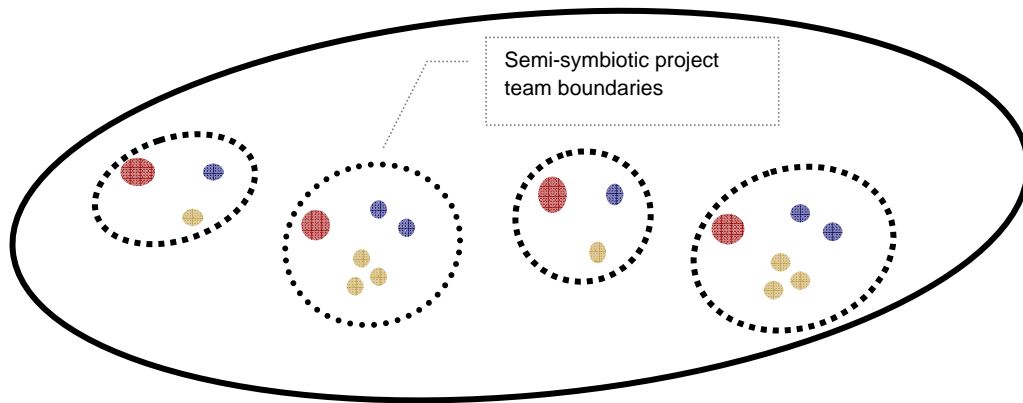


Figure 3. Symbiotic Project Team-based Internal Firm Organization. The dotted lines illustrate the semi-symbiotic nature of internal firm project teams. The boundary of a firm, on the other hand, is strict (solid line). (created by the author)

Despite the real autonomy of teams, most interviewees stated that final decisions are made by the CEO and the board of directors. This is because when new product ideas come up, a momentary decision is very critical because everyone moves so quickly and the market changes every day. Nevertheless, an open and flexible organizational structure allows workers the possibility of participation beyond their specialized areas and contribute.

3.2. Commitment-based human resource practice

Selective hiring, providing job security, and high compensation

Since the continuous learning capacity of digital content developers and long-term relationship are essential, firms try to hire the 'right kind of person' not only in terms of skill levels but also of socially interactive capacity and cultural orientation. In this the formal educational attainment is not the exact measure of individual's capacity. The potential employee's work experience (whether the person was part of a significant project) and references are all considered.

Partly because the industry sector is young and partly because even institutionalized skill-training programs generate only entry level workers, the supply of skilled worker is too limited to keep up with the speed of market expansion and diversification. As of 2005, the majority of

workers with higher qualifications are self-taught through personal devotion to game-playing and computer-related work and have developed their passions into careers as game developers. The shortage of well-trained and experienced workers is such that there is direct competition between large and small firms for qualified creative workers.

There are a few firm strategies commonly identified by interviewees. First is to provide job security. One interviewee stated that:

Although there are many digital content workers out there, many of them have only entry level skills. It is extremely hard to find someone with skills and know-how to lead a project. So once we hire a person with desirable skill sets, we try to retain them as long as we can. (Interview)

One way to retain firm-specific workers is providing job security by hiring them fulltime. This HR practice is consonant with the labor requirement of the temporal and social dimension of the digital content production. Building social capital among team members takes time, thus the internalized system is more advantageous than working with free-lancers or contracting out. Such firms seldom hire part time workers or freelancers. Instead, as the following interview with a digital content development firm suggests, they tend to retain required workers— as many and for as long as they can afford. This also provides underlying reasons for the distinctively high rate of full-time workers in Seoul.

So we'd like to retain the quality of team members instead of hiring freelancers or part-time workers. Second, if team members change frequently, it is hard to maintain team dynamics and this directly affects product quality control. If someone drops out in the middle of the project because he/she may not get along well with other team members, that affects the outcome of the project. In that case, the delay of the schedule is a minor problem. If the head of the project team leaves the company, the fate of the project itself will become endangered. (Interview)

Besides protecting the firm-specific human capital from the competitive labor market and meeting the long-term labor requirements the industry-specific production system, job security also allow workers to explore without fear of appearing irresponsible and to suggest more ideas. Another strategy is to pay close to, or as much as, what large firms pay. As many firms hire digital content workers on full-time basis, the overall turn-over rate is low in the DC industry in Seoul. When asked about the labor turnover rate, the some interviewee noted,

Payment? Of course, for the core work force, for instance game designers, we pay more than other large corporations, such as Samsung, pay their workers who have the same years of experience. (Interview)

While high wage works in favor of workers, this sunk cost can be a burden for small firms, especially they are in competition with large corporations. Therefore, the direct relationship between high compensation and firm performance might be mediating rather than direct.

Providing opportunities for the future: visions and skill training

Providing organizational future vision and investing in skill training are also important HR practices used to retain firm-specific workers. For instance, a small firm will try to diversify business models to new fields such so that the worker does not feel trapped in a dead-end. One interviewee offered:

I think that a company's vision is important to retain workers. If they see more opportunities in this firm, they will stay here longer, period. Other conditions, such as the personal motivations of creating killer-items, are also important factors that retain talented young people in small firms. (From in-depth interview)

Continuous skill training and exposure to new industry trends and new knowledge is also encouraged.

We recommend our workers to attend workshops or game developer academies as part of skill training. But not all of them want to attend those education programs. Some people, especially computer programmers, prefer to study by themselves. (Interview)

Location as a means to attract and retain workers

Some firms also use the locational advantage as an attraction of skilled workers. For instance, I visited one firm that is located in the back alley of Teheran Valley. The building was very small and run-down. This firm was about 5 years old and have so-called killer item. Therefore, the size of the office, quality of the building and the location was unexpected. Although the firm has financial capacity to move to a bigger place outside of Teheran Valley (but not enough to move to a bigger place within the Teheran Valley), they choose to stay in Teheran Valley for practical reasons. The first is the location provides the better access to higher-end labor pool as the following interview narrative suggests:

Being located in Teheran Valley helps us to recruit high-end workers, as many skilled and experienced programmers and content creators continuously rush into Teheran Valley. Due to the name value of Teheran Valley as the Mecca of the ICT industry, many talented young people try to get a job here. They prefer this area for many reasons. It would have been hard for us to hire good designers and programmers if we were located elsewhere. These young people buy the image of Teheran Valley.

Second, the employees like being in Teheran Valley.

I personally want to move to another place where I can even buy my own office space. Teheran Valley is now too expensive. But our workers like to be here. Young people like to hang out here with their friends. It is also important for them to show their business card with the address of this Teheran Valley area because it looks cool. (Interview)

SUMMARY AND CONCLUSION

The case study reveals that DC firms in Seoul strategically allocate their resources on explorative activities, including as firm-specific information collection, high R&D investment and in-house production systems. This finding confirms the hypotheses on a firm's strategic behavior offered by Bosch et al. (page 14). Second, the narratives also show that HR managers in DC firms in Seoul prefer a long-term perspective business model and actively adopt commitment-based HR practices.

This long-term based and commitment-based HR practice of the digital content industry community in Seoul differs from what we typically think of as the business practices that fit for SMEs: lean production system and the reliance of flexibly specialized labor market. Although we know that March's normative recommendation that a firm should balance exploitation and exploration, and Bosch et al.'s suggestions that in a turbulent knowledge environment a firm should place an emphasis on exploration over exploitation, in reality, a firm's strategic choice is not always informed or shaped by these normative criteria. Because the rate of return on long term investment is uncertain at best, particularly in a newly emerging sectors, especially during periods of economic austerity, SMEs, tend to go down the road of short-term exploitation: attempting to find those individuals who already know what to do and poaching them from other firms.

The case of DC industry sector in Seoul presents that the balance between exploitation and exploration in fact possible beyond normative recommendation. In such turbulent conditions, lacking control over external conditions, firms strive to increase certainty and stability

internally by investing in firm-specific human resources and by motivating them. These firm-specific and motivated human resources also allow firms to respond to the external changes with agility as shown in the case of company A. In fact, pursuing a strategy that relies on networking and exploitation may be futile in conditions of rapid change. Essentially, uncertainty and lack of information are real and spread across the industry. The better response may be to develop a firm's capacity to respond to change.

I also argue that the DC business community's ability to practice an exploration-strategy is not only formed by the market force but also undergirded by their proactive acknowledgement of the important role played by the firm-specific human resources in their continuous and incremental innovation. The important contributions of workers in their day-to-day activities as identified by HR personnel and CEOs can be categorized as the followings:

First, employees who possess knowledge about a firm's product, consumer orientation and desire, and the work process is a critical resource as a firm works to cultivate its distinctive capacity. The case study highlights a few areas where firm specific human capital plays important roles.

- 1) They know what information and knowledge is important for developing new product for the firm;
- 2) They play an important role in managing both the cognitive and transactional 'relationship' between firms and between the firm and customers;
- 3) Firm specific human capital is also the repository of the firm's product specific user and product related knowledge; and,
- 4) By managing the cognitive and transactional relationship between firms and between the firm and customers, such employees effectively find, absorb, and transform the scarce information needed for the firm to develop specific new products .

Second, the managers of DC firms clearly stated that retaining those skilled and firm-specific employees is the key to their HR practice. Retention of skilled employees with firm specific knowledge is motivated by a few aspects:

- 1) Scarcity of individuals qualified in new product development;
- 2) The critical importance of the social capital constructed among team members in sharing knowledge and keeping up the dynamics of work; and

3) The high cost of replacing the team member--if one team member leaves in the middle of product development, the impact is beyond losing one person. Depending on the reputation and social status of the person, one loss can induce others (for instance, sometimes, the entire team will leave following one person). Therefore, DC firms employ commitment-based HR practices, including high compensation, job security, future visions and training opportunities, and locational amenity.

In summary, this case highlights two important but less explored aspects in the literature: knowledge workers play essential roles beyond absorbing and diffusing knowledge.

- 1) Motivated and firm-specific workers are key resource in managing interfirm and consumer relations;
- 2) Motivated and firm-specific workers are the key nodes for collecting important information and knowledge that might lead to innovation; and
- 3) The social capital constructed among motivated and firm-specific workers is the key to sustaining the incremental innovation of product. Finally, the consistency between the descriptive statistics from the survey data and the narratives drawn from indepth interview data suggest that the long term business model and commitment-based HR practices make up at least the dominant regional culture.

This case study provides evidence that there is an imperative need to extend the current theoretic model of the innovative region to integrate a dimension that addresses workforce and employment practices. I show that while a system level analysis, or perhaps a system, can explain/foster information flow, it captures one side of continuum of the process of innovation where, internally, workers and a firm's employment practice play a significant role.

For a comprehensive understanding of how this regional culture came to exist and whether this culture and system can sustain for a longer period or is a temporary phenomena further study is needed. This study also does not address whether the culture is replicable and what role, if any, institutional efforts or policies specific to Korean labor-industrial relations and forms of capitalism played. However, one can draw some suggestive policy implications from this case which will be discussed in the following section.

POLICY IMPLICATIONS (for the U.S. context)

In light of the fact that findings from the case study partially support the arguments of the high performance HR practice literature, I would like to suggest the need to revisit the current

local and regional high-technology industry related policies and strengthen policies that can induce commitment-based HR practices. While local and regional policy makers did not intentionally facilitate or choose to be in support of high mobility of workers, the lack of institutional actions to provide better retention of workers at the individual firm level leaves workers under conditions of chronic job insecurity and firms at a sub-optimal level. For instance, it is not rare to find situations where on one hand, a local government invests in high-tech venture incubators by converting a warehouse to accommodate young and promising local high tech entrepreneurs. On the other hand, firms either suffer from the shortage of properly skilled workers or struggle to retain skilled workers who are inclined to move to bigger firms or bigger cities. Some commentators and researcher are swift to argue that high turnover is a natural consequence of skilled workers who are more loyal to their profession than to an organization. Thus it is important to create a local milieu that appeals to those who have bohemian and cosmopolitan life styles as a magnet to attract people from outside and keep them longer in the locality. So does another vicious cycle begin: a local government makes an investment in improving urban design aspects of the city. This may attract more individuals with creative capacity, however, as long as the slipperiness at the job or employee 'Body Shopping' persists, it may difficult to break out from constant shortage of skilled and firm-specific knowledge ridden individuals.

The important question is: can local economic planners induce changes at individual firm level strategies, in particular human resource related practice? I would like to suggest that the change should occur both at local-regional level and national efforts.

Wage subsidies for new higher Local or regional government can initiate the changes into the commitment-based HR practice. Localities should expand wage subsidies from economically depressed areas to resource-less new firms and start-ups. This will increase the number of jobs and possibly solve the job-skill mismatch problem.

Favoring the high-wage low-turnover firms While the wage subsidy is only applied for the new employees and should substantial share of labor cost, the policy should favor firms transforming their business model into one favoring high-wage and low turnover over years. Making the wage subsidy depend on the number of new hire might induce some companies to layoff workers and newly hire every year, which will in fact increase high turnover rate. This

way, a locality and region can not only increase the employment rate but also promote endogenous human resource growth.

Consensus at the regional corporate governance: creating peer pressure At the same time, local and regional authorities should create a local and regional consensus on the importance of commitment-based HR practices by forming corporate governance groups. HR practice is not solely in the domain of individual firm's rational choices: it is also a matter of shared culture. Therefore, creating the consensus and peer-pressure through the corporate governance is necessary to prevent free-riders.

Federal (national) level support Finally, these local and regional level efforts should be supported by the federal (national) level policy directions. Both a promotional voice and financial support can significantly increase the effectiveness of local and regional level efforts. The existing federal level policies such as New Jobs Tax Credit (\$5000 credit per each new employee) should also include conditions to reinforce high-wage and long-term high employment.

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APPENDICES

I am currently developing a new model to test the effects of various elements of innovation including external, internal absorptive capacity, and commitment-based HR practice. Below, I include the preliminary result.

Samples

Samples are drawn from a national survey of software firms conducted by the Korea IT Industry Promotion Agency (KIPA) a subsidiary organization of the Ministry of Information and Communication (as of 2004), in 2004. For the purpose of this analysis, I chose 353 firms located within six digital content clusters in Seoul, Korea. I used this data because the survey contains information about the characteristics and HR practices of digital content creators in Seoul that coincided nicely with my study goal. The KIPA survey data analysis included 358 small- to medium-sized digital industry-related firms. Using a random sampling method, 3,187 firms were selected as a sample population for Seoul, a figure that represents 38% of the total population of firms in Seoul. Among the 3,187 surveys sent to the selected firms, 443 surveys were returned properly. Of unreturned surveys, 1,086 were returned with notations that the firms had closed or with markings that indicated a delivery failure. Another 452 firms declined to participate in the survey. Another 103 survey attempts failed for unknown reasons. And the rest of surveys failed due to a mailing address error. Among these 443 responses, 358 responses fell within the boundaries of the six digital content industry clusters in Seoul.

Variables

Dependent Variable The dependent variable, innovativeness, is measured by the proportion of original software (inclusive of both software programs used to create content and the content itself) sales compared to total sales. In much innovation literature, patents have been used as a proxy measure of innovation. However, complications of dealing with patents as a proxy for innovation have been reported. For instance the count of patent does not reflect how recently the invention occurred. Many old firms own original patents but have not engaged in any recent innovation activities. More importantly, the nature of digital content creation is such that it takes a long time for a firm to develop a new character, content, and technology that are patentable, and firms that are in their early development may not have many patents. The many

missing values in the patent question suggest that digital content firms located in Seoul are not focused on generating patents.

The original dependent variable is scale data. However the distribution of the variable was dyadic which violates the linearity assumption of the multiple linear regression (the first assumption). Therefore, I transformed the dependent variable into a binary variable (0=less innovative, 1=more innovative) by dividing it at the median value. For other variables, please see the table below.

TABLE 1.Independent and contrpl variables

Variable name	Description
<i>Internal Resource (Absorptive Capacity) Variables</i>	
R&D	% of R&D investment compared to the total revenue
MA_P	% of employees with master's degree
HA_P	% of employees with high school graduate
<i>Commitment-based HR variables</i>	
Tenure	Average number of years of retention of workers (including part time workers)
HighskillwrksP	% of high skilled workers
Avg_Wage	Average wage currently paid
<i>External Variables</i>	
Coll_Uni	Number of collaboration experience with universities
Institutions	Number of institutions affiliated
Dg_Pro Ser	Degree of producer service use measured from 1 to 6
<i>Controll Variables</i>	
FirmAge	Firm age
TotalSale	Total sales

TABLE 2. Results of Logistic Regression

Variables	Model 1	Model 2	Model 3	Model 4
Constant	-.113	-.486	-.008	-.432
R&D	.911			.951
MA_P	.349			.300
HA_P	.995			.842
Tenure		.027*		.029*
HighskillwrksP		.061**		.093**
Avg_Wage		.319		.299
Coll_Uni			.488	.796
Institutions			.253	.453
Dg_Pro Ser			.910	.659
FirmAge	.028*	.050*	.022*	.043*
TotalSale	.000*	.000*	.001*	.000*

N=323, *. $P < 0.05$ level (2-tailed). **<0.1 level (2-tailed).